

MINISTRY OF EDUCATION, SINGAPORE
in collaboration with
UNIVERSITY OF CAMBRIDGE LOCAL EXAMINATIONS SYNDICATE
General Certificate of Education Ordinary Level

Paper 1 Multiple Choice

October/November 2018

1 hour

Additional Materials: Multiple Choice Answer Sheet

READ THESE INSTRUCTIONS FIRST

Write in soft pencil.

Do not use staples, paper clips, glue or correction fluid.

Write your name, Centre number and index number on the Answer Sheet in the spaces provided unless this has been done for you.

DO NOT WRITE IN ANY BARCODES.

There are **forty** questions on this paper. Answer **all** questions. For each question there are four possible answers **A, B, C** and **D**.

Choose the **one** you consider correct and record your choice in **soft pencil** on the separate Answer Sheet.

Read the instructions on the Answer Sheet very carefully.

Each correct answer will score one mark. A mark will not be deducted for a wrong answer.

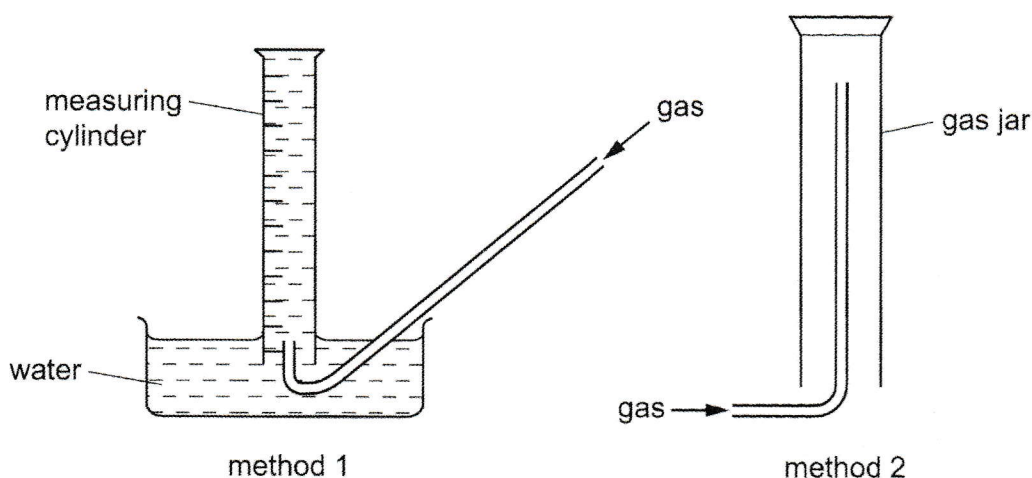
Any rough working should be done in this booklet.

A copy of the Data Sheet is printed on page 15.

A copy of the Periodic Table is printed on page 16.

The use of an approved scientific calculator is expected, where appropriate.

21 The diagrams show two methods of collecting gases.



Which row gives the properties of a gas that can be collected by both methods?

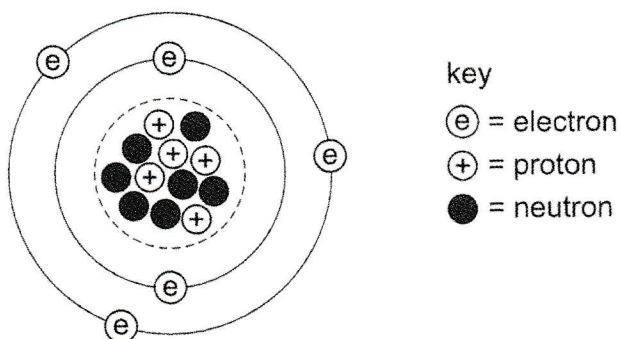
| | property 1 | property 2 |
|---|--------------------|---------------------|
| A | insoluble in water | denser than air |
| B | insoluble in water | less dense than air |
| C | soluble in water | denser than air |
| D | soluble in water | less dense than air |

22 Gas X is soluble in water. Its solution turns red litmus paper blue.

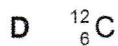
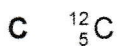
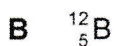
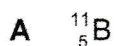
Which statement is **not** correct?

- A A green precipitate is obtained when an aqueous solution of X is added one drop at a time to aqueous iron(III) nitrate.
- B A white precipitate is produced, which then dissolves when an aqueous solution of X is added one drop at a time to aqueous zinc nitrate.
- C Gas X could be made by warming ammonium nitrate with aqueous sodium hydroxide.
- D Gas X could be made by warming calcium nitrate with aqueous sodium hydroxide and powdered aluminium.

23 The diagram shows the structure of an atom.



Which atom is represented by the diagram?



24 Which statement describes the formation of a covalent bond?

- A Electrons are shared between metallic atoms.
- B Electrons are shared between non-metallic atoms.
- C Electrons are transferred from a metallic atom to a non-metallic atom.
- D Electrons are transferred from a non-metallic atom to a metallic atom.

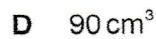
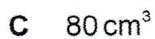
25 20 cm^3 of ethene are reacted with 70 cm^3 of oxygen.

The equation for the reaction is shown.



All volumes are measured at r.t.p.

What is the **total** volume of gas remaining at the end of the reaction?



- 26 Acid rain contains sulfuric acid.

25 cm³ of acid rain is neutralised by 28 cm³ of 0.5 mol/dm³ aqueous sodium hydroxide.

The equation for the reaction is shown.



What is the concentration of sulfuric acid in the acid rain?

- A 0.28 mol/dm³
B 0.56 mol/dm³
C 1.12 mol/dm³
D 28.00 mol/dm³
- 27 Four different solids, W, X, Y and Z, are dissolved in equal volumes of water at 20 °C.

The table shows the change in temperature when each solid dissolves.

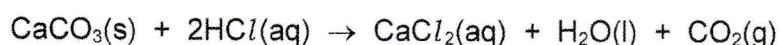
| | W | X | Y | Z |
|----------------------------|-----|----|----|-----|
| change in temperature / °C | +10 | −8 | −5 | +15 |

Which row describes the energy change when the solids are dissolved in water?

| | solid which dissolves | type of energy change | solid which dissolves | type of energy change |
|---|-----------------------|-----------------------|-----------------------|-----------------------|
| A | W | endothermic | Y | exothermic |
| B | X | endothermic | Z | exothermic |
| C | X | exothermic | W | endothermic |
| D | Y | exothermic | Z | endothermic |

- 28 Calcium carbonate reacts with hydrochloric acid.

The equation for the reaction is shown.



Which change in the conditions increases the speed of reaction?

- A Decrease the temperature.
B Decrease the volume of hydrochloric acid.
C Increase the concentration of hydrochloric acid.
D Increase the size of the calcium carbonate solid pieces.

29 Which change represents oxidation?

- A $\text{Cl}_2 \rightarrow 2\text{Cl}^-$
- B $\text{CuO} \rightarrow \text{Cu}$
- C $\text{Fe}^{3+} \rightarrow \text{Fe}^{2+}$
- D $\text{Zn} \rightarrow \text{Zn}^{2+}$

30 Which statement about acids and bases is **not** correct?

- A Acids react with metals to give hydrogen.
- B Acidic oxides are formed from metals reacting with oxygen.
- C Alkalis dissolve in water forming hydroxide ions.
- D Hydrogen ions react with hydroxide ions to produce water.

31 Why is calcium hydroxide added to soil?

- A to decrease pH and neutralise acidity
- B to decrease pH and neutralise alkalinity
- C to increase pH and neutralise acidity
- D to increase pH and neutralise alkalinity

32 Which property of the Group I elements decreases moving down the group?

- A melting point
- B number of electrons in the outer shell of an atom of the element
- C number of electron shells in an atom of the element
- D reactivity with water

33 The reactivity series for some metals is shown.

| | | | | | |
|---------------|----|----|----|----------------|----|
| most reactive | | → | | least reactive | |
| Mg | Al | Zn | Fe | Cu | Ag |

Which reaction will occur?

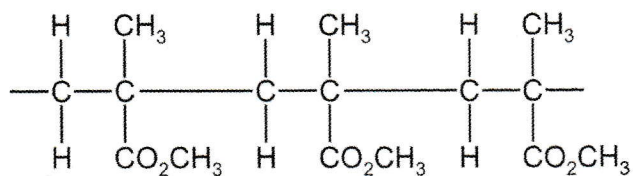
- A aluminium oxide + iron \rightarrow aluminium + iron(III) oxide
- B copper(II) nitrate + silver \rightarrow copper + silver nitrate
- C iron(II) sulfate + copper \rightarrow iron + copper(II) sulfate
- D zinc sulfate + magnesium \rightarrow zinc + magnesium sulfate

- 34 Which statement is **not** a reason for recycling iron?
- A Recycling decreases the amount of natural resources available.
 - B Recycling decreases the amount of scrap iron accumulating in the environment.
 - C Recycling decreases the energy requirement.
 - D Recycling decreases the environmental damage due to mining.
- 35 What is the approximate composition of dry air?
- A 78% nitrogen, 21% oxygen and 1% carbon dioxide
 - B 78% nitrogen, 21% oxygen and 1% noble gases
 - C 78% nitrogen, 21% oxygen, 1% noble gases and carbon dioxide
 - D 78% oxygen, 21% nitrogen, 1% noble gases and carbon dioxide
- 36 Common pollutants of the air are shown.
- 1 carbon monoxide
 - 2 methane
 - 3 nitrogen dioxide
 - 4 sulfur dioxide

Which pollutants cause the erosion of buildings?

- A 1 and 3 B 1 and 4 C 2 and 4 D 3 and 4
- 37 Which statement is correct for both alkanes and alkenes?
- A Both are unsaturated hydrocarbons.
 - B Both contain a double bond.
 - C Both decolourise aqueous bromine water.
 - D Both undergo complete combustion producing carbon dioxide and water.
- 38 Which hydrocarbons are members of the same homologous series?
- A C_5H_{10} and C_5H_8
 - B C_5H_{10} and C_5H_{12}
 - C CH_4 and C_2H_4
 - D CH_4 and C_6H_{14}

39 A section of an addition polymer is shown.



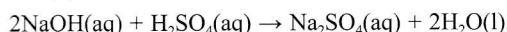
Which row describes the monomer used to make this polymer?

| | type of compound | effect of adding aqueous bromine |
|---|------------------|----------------------------------|
| A | saturated | reddish-brown to colourless |
| B | saturated | remains reddish-brown |
| C | unsaturated | reddish-brown to colourless |
| D | unsaturated | remains reddish-brown |

40 Which change **cannot** be achieved by a single chemical reaction?

- A ethanol to ethanoic acid
- B ethanol to propanol
- C ethene to poly(ethene)
- D glucose to ethanol and carbon dioxide

(ii)



EXAM TIP:

acid + base \rightarrow salt + water

(c) (i)

Number of moles of NaOH = $3 \times 4 = 12$ mol
Mass of NaOH required = $12 \times (23 + 16 + 1)$
= 480 g

EXAM TIP:

Concentration (mol / dm^3) = $\frac{\text{Number of moles of solute}}{\text{Volume} (\text{dm}^3)}$

Mass = Number of moles \times Molar mass

(ii) Number of moles of H_2SO_4
= number of moles of NaOH $\div 2$
= $12 \div 2$
= 6 mol

EXAM TIP:

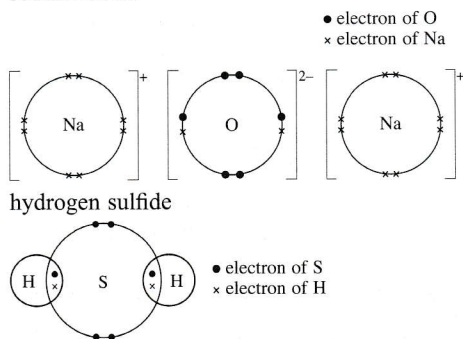
Use the balanced equation to find the mole ratio.

10. (a) 1. A mixture is made up of two or more substances that are not chemically combined, but a compound is made up of two or more elements that are chemically combined.
2. The components of a mixture can be mixed in any ratio, but the elements in a compound are always combined in a fixed ratio.

(Other acceptable answers:

- The components of a mixture can be separated by physical processes, but a compound can only be broken down into its elements by chemical processes.
- The chemical properties of a mixture are the same as its components, but the physical and chemical properties of a compound are different from those of its constituent elements.)

(b) sodium oxide



EXAM TIP:

Sodium oxide is an ionic compound; hydrogen sulfide is a simple covalent compound.

(c) (i) Solid sodium oxide has a giant lattice structure with strong electrostatic forces of attraction between oppositely-charged ions. There are no mobile ions to conduct electricity as the ions are held in fixed position in the lattice structure.

Gaseous hydrogen sulfide has a simple molecular structure. There are no mobile ions or electrons to conduct electricity.

EXAM TIP:

Relate physical properties of ionic compounds to their lattice structure and covalent substances to their structure and bonding.

(ii) In the molten state, the giant lattice structure of sodium oxide is broken down, thus the ions are free to move and act as mobile charge carriers to conduct electricity.

EXAM TIP:

Recognise the difference between solid and molten states in the lattice structure.

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Paper 1

Multiple Choice Questions

21. (B)

The displacement method is suitable for insoluble gases as soluble gases would dissolve in water.

Upward delivery is used for gases less dense than air as they would displace air at the top of the gas jar.

EXAM TIP:

Displacement method (method 1) is used to collect gases which are not very soluble in water; upward delivery (method 2) is used to collect gases which are less dense than air.

22. (A)

Gas X is most likely to be ammonia, a basic gas that is soluble in water.

When ammonia is added to iron(III) nitrate, a reddish-brown precipitate is obtained instead of a green precipitate.

EXAM TIP:

Alkalis turn red litmus paper blue.

23. (B)

The atom contains 7 neutrons and 5 protons, and therefore has a nucleon (or mass) number of 12.

Since it has 5 protons, from the Periodic Table, the atom is boron.

EXAM TIP:

Each element is represented by a unique chemical symbol ${}_Z^AX$, where A is the nucleon number, Z is the proton number and X is the chemical symbol of the element.

24. (B)

Electrons are shared between non-metallic atoms to achieve a stable electronic configuration in a covalent compound.

EXAM TIP:

Covalent bonds are formed by the sharing of electrons between non-metallic atoms.

25. (B)

From the balanced equation, 1 mol of C_2H_4 reacts with 3 mol of O_2 .

$$\text{Volume of } O_2 \text{ reacted} = 20 \text{ cm}^3 \times 3 = 60 \text{ cm}^3$$

$$\text{Volume of } O_2 \text{ unreacted} = 70 \text{ cm}^3 - 60 \text{ cm}^3 = 10 \text{ cm}^3$$

Since 1 mol of C_2H_4 produces 2 mol of CO_2 ,

$$\text{Volume of } CO_2 \text{ produced} = 20 \text{ cm}^3 \times 2 = 40 \text{ cm}^3$$

$$\begin{aligned} \text{Total volume of gas remaining at the end of reaction} \\ = 10 \text{ cm}^3 + 40 \text{ cm}^3 \\ = 50 \text{ cm}^3 \end{aligned}$$

EXAM TIP:

Identify the limiting reagent in the reaction. The mole ratio of the stoichiometric equation is equal to the volume ratio of gas reacted/formed.

26. (A)

$$\begin{aligned} \text{Number of moles of NaOH used} &= \frac{28}{1000} \times 0.5 \\ &= 0.014 \text{ mol} \end{aligned}$$

$$\begin{aligned} \text{Number of moles of } H_2SO_4 \text{ reacted} &= \frac{0.014}{2} \\ &= 0.007 \text{ mol} \end{aligned}$$

$$\begin{aligned} \text{Concentration of } H_2SO_4 &= 0.007 \div \frac{25}{1000} \\ &= 0.28 \text{ mol / dm}^3 \end{aligned}$$

EXAM TIP:

Number of moles of a substance = Concentration \times Volume;

$$\text{Concentration (mol / dm}^3\text{)} = \frac{\text{Number of moles of solute}}{\text{Volume (dm}^3\text{)}}$$

27. (B)

In an exothermic reaction, energy is released and the temperature of the surroundings increases. Thus, the positive changes in temperature for solids W and Z indicate an exothermic reaction. In an endothermic reaction, energy is absorbed and the temperature of the surroundings decreases. Thus, the negative changes in temperature for solids X and Y indicate an endothermic reaction.

EXAM TIP:

An exothermic reaction results in a positive change in temperature; an endothermic reaction results in a negative change in temperature.

28. (C)

Increasing the concentration of reactants results in an increase in the speed of reaction. A decrease in the temperature and an increase in the size of the calcium carbonate will decrease the speed of reaction.

Decreasing the volume of hydrochloric acid will not change the speed of reaction.

EXAM TIP:

Increase in temperature, increase in concentration of reactant, and decrease in size of reactant lead to increase in the rate of reaction.

29. (D)

(A): The oxidation state of Cl decreased from 0 in Cl_2 to -1 in Cl^- , hence reduction occurred.

(B): The oxidation state of Cu decreased from $+2$ in CuO to 0 in Cu , hence reduction occurred.

(C): The oxidation state of Fe decreased from $+3$ in Fe^{3+} to $+2$ in Fe^{2+} , hence reduction occurred.

(D): The oxidation state of Zn increased from 0 in Zn to $+2$ in Zn^{2+} , hence oxidation occurred.

EXAM TIP:

Calculate the oxidation state of the reactant and product. During oxidation, the oxidation state of the element increases.

30. (B)

Acidic oxides are formed from non-metals reacting with oxygen, thus (B) is incorrect.

EXAM TIP:

Recall the chemical reactions of acids and bases. Recall the definition of acidic oxide and alkali.

31. (C)

Calcium hydroxide is a base, which dissolves in water in the soil to produce OH^- ions. This increases the pH of the soil and neutralises acidity in the soil.

EXAM TIP:

Calcium hydroxide is a base and would thus increase pH by reacting with acids (neutralise acidity).

32. (A)

The melting point decreases down the group. All Group I atoms have one valence electron each, while the number of electron shells and reactivity increase down the group.

EXAM TIP:

Recall the trends of physical and chemical properties of Group I metals.

33. (D)

Since magnesium is more reactive than zinc, it will displace zinc from its salt to form magnesium sulfate and zinc metal.

EXAM TIP:

The more reactive element displaces the less reactive element in a reaction.

34. (A)

Recycling reduces the need for mining for raw materials and conserves the amount of natural resources available.

EXAM TIP:

Recall the advantages of recycling metals.

35. (C)

EXAM TIP:

Dry air consists of approximately 78% nitrogen, 21% oxygen, 0.97% noble gases (mainly argon) and 0.03% carbon dioxide.

36. (D)

Acid rain results when nitrogen oxides and sulfur dioxide dissolve in rain water. Acid rain causes the erosion of buildings when it reacts with structures with metal or carbonates.

EXAM TIP:

Nitrogen dioxide and sulfur dioxide cause the erosion of buildings.

37. (D)

Alkanes are saturated hydrocarbons, do not contain a double bond and will not decolourise aqueous bromine water, unlike alkenes.

EXAM TIP:

Both alkanes and alkenes undergo complete combustion, producing carbon dioxide and water.

38. (D)

Both CH_4 and C_6H_{14} have the same general formula of $\text{C}_n\text{H}_{2n+2}$.

EXAM TIP:

The general formula of alkanes is $\text{C}_n\text{H}_{2n+2}$ and the general formula of alkenes is C_nH_{2n} .

39. (C)

The monomer used is an alkene, which is unsaturated. Alkenes react with aqueous bromine via addition reaction, changing its colour from reddish brown to colourless.

EXAM TIP:

Addition polymerisation occurs for unsaturated monomers. When aqueous bromine is added to an unsaturated compound, the colour of aqueous bromine will turn from reddish-brown to colourless.

40. (B)

(A): Ethanol undergoes oxidation to form ethanoic acid.

(C): Ethene undergoes addition polymerisation to form poly(ethene).

(D): Glucose undergoes fermentation to form ethanol and carbon dioxide.

No single chemical reaction can directly convert ethanol to propanol.

EXAM TIP:

Recall the reactions of organic compounds.

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Paper 3

Section A

1.

| element | metal or non-metal | formula of oxide | nature of oxide (acidic or basic or amphoteric) |
|-----------|--------------------|-------------------------|---|
| sulfur | non-metal | SO_2 | acidic |
| potassium | metal | K_2O | basic |
| aluminium | metal | Al_2O_3 | amphoteric |

EXAM TIP:

Non-metals usually form acidic oxides; metals usually form basic oxides; amphoteric oxides display both acidic and basic properties.

2. (a) (i) B

EXAM TIP:

The colouring with spot that remains at the start line of the chromatography paper is insoluble in ethanol.

(ii) E

EXAM TIP:

Three spots on the chromatography paper indicate that the colouring is a mixture of only three food colourings.

(iii) A

EXAM TIP:

The colouring with two spots at the exact same positions as the two spots of Z contains poisons and so should not be used in foods.

(b) D and E

EXAM TIP:

Look for two food colourings that have three spots at the exact same positions.